

What is claimed is:

1. A system, comprising:
 - (A) a material metering machine having a load cell, the load cell being configured to generate an analog signal, the analog signal being indicative of a load on the load cell;
 - (B) an analog-to-digital converter configured to convert the analog signal into a digital signal, the digital signal having a sampling rate of 307.2 kHz;
 - (C) a preliminary decimation element comprising:
 - (C1) a first finite-impulse-response (FIR) filter having a decimation ratio of 16, the first FIR filter being configured to reduce the sampling rate of the digital signal from 307.2 kHz to 19.2 kHz; and
 - (C2) a second FIR filter serially coupled to the first FIR filter, the second FIR filter having a decimation ratio of 16, the second FIR filter being configured to reduce the sampling rate of the digital signal from 19.2 kHz to 1200 Hz;
 - (D) a primary decimation element serially coupled to the preliminary decimation element, the primary decimation element comprising:
 - (D1) a third FIR filter having a decimation ratio of 2, the third FIR filter being configured to reduce the sampling rate of the digital signal from 1200 Hz to 600 Hz;
 - (D2) a fourth FIR filter having a decimation ratio of 10, the fourth FIR filter being configured to reduce the sampling rate of the digital signal from 600 Hz to 60 Hz; and
 - (D3) a fifth FIR filter having a decimation ratio of 6, the fifth FIR filter being configured to reduce the sampling rate of the digital signal from 60 Hz to 10 Hz; and

- 24 (E) a filter bank serially coupled to the primary decimation element, the filter bank
 25 comprising:
- 26 (E1) selectable filters, each filter being configured to reduce the noise, the
 27 selectable filters including a filter having a sub-hertz 3-dB cutoff frequency,
 28 the selectable filters comprising a filter selected from the group consisting of:
- 29 (E1a) a SINC filter; and
 30 (E1b) a raised cosine filter; and
- 31 (E2) a selectable filter switch configured to select a selectable filter, the selectable
 32 filter being selected as a function of operating criteria, the operating criteria
 33 being associated with the material metering machine, the operating criteria
 34 being determined through a closed feedback loop

- 1 2. A system, comprising:
 2 a material metering machine comprising a decimation element; and
 3 a filter bank, the filter bank comprising:
 4 an input node adapted to receive a signal from the decimation element, the
 5 signal having noise from the material metering machine;
 6 selectable filters, each selectable filter having a sub-hertz 3-dB cutoff
 7 frequency, each filter being configured to reduce the noise.

- 1 3. A system, comprising:
 2 a filter bank input node adapted to receive a signal having noise; and
 3 selectable filters, each filter being configured to reduce the noise, the selectable filters
 4 including a filter having a sub-hertz 3-dB cutoff frequency.

1 4. The system of claim 3, wherein the selectable filters include a SINC filter.

1 5. The system of claim 4, wherein the SINC filter has a cutoff frequency, the
2 cutoff frequency being selected from a group consisting of:

3 approximately 0.10 Hz;

4 approximately 0.12 Hz;

5 approximately 0.15 Hz;

6 approximately 0.20 Hz;

7 approximately 0.25 Hz;

8 approximately 0.32 Hz;

9 approximately 0.40 Hz;

10 approximately 0.50 Hz; and

11 approximately 0.70 Hz.

1 6. The system of claim 3, wherein the selectable filters include a raised cosine
2 filter.

1 7. The system of claim 6, wherein the raised cosine filter has a cutoff frequency,
2 the cutoff frequency being selected from a group consisting of:

3 approximately 0.20 Hz;

4 approximately 0.30 Hz; and

5 approximately 0.40 Hz.

1 8. The system of claim 3, further comprising:
2 a material metering machine that contributes to the noise in the signal.

1 9. The system of claim 8, wherein the material metering machine is adapted to
2 measure a flow rate of material.

1 10. The system of claim 8, wherein the material metering machine is adapted to
2 measure weight of material within the material metering machine.

1 11. The system of claim 8, further comprising a selectable filter switch configured
2 to select a selectable filter, the selectable filter being selected as a function of operating
3 criteria, the operating criteria being associated with the material metering machine, the
4 operating criteria being determined through a closed feedback loop.

1 12. The system of claim 3, further comprising a decimation element configured to
2 provide the signal to the filter bank input node.

1 13. The system of claim 3, further comprising means for providing the signal to
2 the filter bank input node.

1 14. A filtering method, comprising the steps of:
2 receiving a signal having noise;
3 selecting a filter, the filter being selected from a plurality of selectable filters, the
4 plurality of selectable filters including a filter having a sub-hertz 3-dB cutoff frequency; and
5 filtering the signal using the selected filter to reduce the noise.

1 15. The method of claim 14, wherein the step of selecting the filter comprises the
2 step of:
3 selecting a SINC filter.

1 16. The method of claim 15, wherein the step of selecting the SINC filter
2 comprises the step of:
3 selecting a SINC filter having a sub-hertz 3-dB cutoff frequency.

1 17. The method of claim 14, wherein the step of selecting the filter comprises the
2 step of:
3 selecting a raised cosine filter.

1 18. The method of claim 17, wherein the step of selecting the raised cosine filter
2 comprises the step of:
3 selecting a raised cosine filter having a sub-hertz 3-dB cutoff frequency.

1 19. A filtering apparatus, comprising:
2 a primary input node configured to receive a digital signal, the digital signal having an
3 initial sampling rate, the digital signal further having line noise; and
4 a primary decimation element having a decimation ratio, the primary decimation
5 element further having a filter length, the primary decimation element being configured to
6 reduce the line noise at 50 Hz, the primary decimation element further being configured to
7 reduce the line noise at 60 Hz, the primary decimation element further being configured to
8 reduce the initial sampling rate to a reduced sampling rate as a function of the decimation
9 ratio.

1 20. The apparatus of claim 19, wherein the initial sampling rate is 1200 Hz.

1 21. The apparatus of claim 19, wherein the reduced sampling rate is 10 Hz.

1 22. The apparatus of claim 19, wherein the primary decimation element
2 comprises:

3 a first filter having a decimation ratio of 2;

4 a second filter serially coupled to the first filter, the second filter having a decimation
5 ratio of 10; and

6 a third filter serially coupled to the second filter, the third filter having a decimation
7 ratio of 6.

1 23. The apparatus of claim 19, further comprising an analog-to-digital (A/D)
2 converter, the A/D converter being configured to receive an analog signal, the A/D converter
3 further being configured to convert the analog signal into the digital signal, the A/D converter
4 further being configured to provide the digital signal to the primary input node.

1 24. The apparatus of claim 19, further comprising a preliminary decimation
2 element having an input, the preliminary decimation element further having an output, the
3 output of the preliminary decimation element being communicatively coupled to the primary
4 input node, the preliminary decimation element comprising:

5 a first filter having a decimation ratio of 16; and

6 a second filter serially coupled to the first filter, the second filter having a decimation
7 ratio of 16.

1 25. The apparatus of claim 24, further comprising an analog-to-digital (A/D)
2 converter, the A/D converter being configured to receive an analog signal, the A/D converter
3 further being configured to digitize the analog signal, the A/D converter further being
4 configured to provide the digitized signal to the input of the preliminary decimation element.

1 26. A filtering method, comprising the steps of:
2 receiving a digital signal, the digital signal having an initial sampling rate, the digital
3 signal further having line noise;
4 filtering the line noise at 50 Hz;
5 filtering the line noise at 60 Hz; and
6 reducing the initial sampling rate of the digital signal to a reduced sampling rate.

1 27. The method of claim 26, wherein the step of receiving the digital signal
2 comprises the step of receiving a digital signal having a sampling rate of 1200 Hz.

1 28. The method of claim 26, wherein the step of filtering the line noise at 50 Hz
2 comprises the step of cascading the digital signal through multiple filters.

1 29. The method of claim 26, wherein the step of filtering the line noise at 60 Hz
2 comprises the step of cascading the digital signal through multiple filters.

1 30. The method of claim 26, wherein the step of reducing the initial sampling rate
2 comprises the step of cascading the digital signal through multiple filters.

1 31. The method of claim 26, further comprising the step of cascading the digital
2 signal through multiple filters.

1 32. The method of claim 31, wherein the step of cascading the digital signal
2 through multiple filters comprises the step of directing the digital signal through a filter
3 having a decimation ratio of 16.

1 33. The method of claim 31, wherein the step of cascading the digital signal
2 through multiple filters comprises the step of directing the digital signal through a filter
3 having a decimation ratio of 2.

1 34. The method of claim 31, wherein the step of cascading the digital signal
2 through multiple filters comprises the step of directing the digital signal through a filter
3 having a decimation ratio of 10.

1 35. The method of claim 31, wherein the step of cascading the digital signal
2 through multiple filters comprises the step of directing the digital signal through a filter
3 having a decimation ratio of 6.

1 36. The method of claim 26, further comprising the steps of:
2 receiving an analog data signal from a load cell, the load cell being located on a
3 material metering machine; and
4 converting the analog signal into the digital signal.

1 37. The method of claim 26, wherein the step of converting the analog signal
2 comprises the step of:
3 generating a digital signal having a sampling rate of 1200 Hz.